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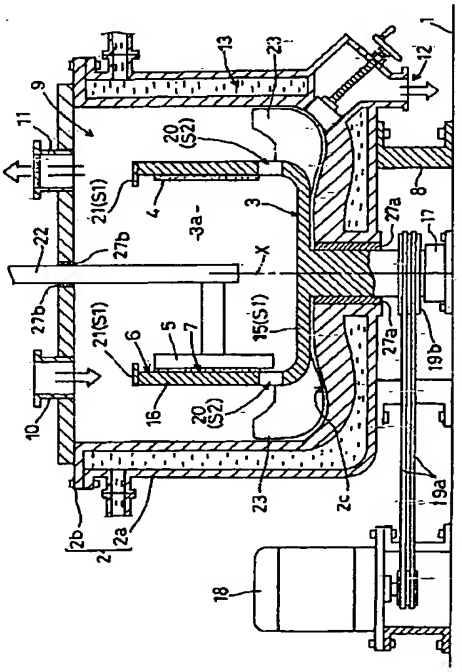
(54)【発明の名称】　粉体処理装置

(57)【要約】
【課題】　被処理物の処理能力および操作性に優れた粉体処理装置を提供する。
【解決手段】　鉛直方向に沿った回転軸心Ｘの回りに回転自在であり、被処理物４が押し付けられる受け面６を内周部に有する筒状回転体３と、受け面６に近接するよう筒状回転体３の内部に配置したインナーピース５とを備えた粉体処理装置であって、受け面６とインナーピース５との間に形成する押圧部７に被処理物４を保持するための被処理物保持手段Ｓ１を有すると共に、押圧部７に保持された被処理物４の一部を、前記筒状回転体３が駆動回転している際に前記筒状回転体３の内包空間３ａの外部に排除するための被処理物排除手段Ｓ２を有している。



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【特許請求の範囲】

【請求項１】　鉛直方向に沿った回転軸心の回りに回転自在であり、被処理物が押し付けられる受け面を内周部に有する筒状回転体と、前記受け面に近接するよう前記筒状回転体の内部に配置したインナーピースとを備えた粉体処理装置であって、

前記受け面と前記インナーピースとの間に形成する押圧部に前記被処理物を保持するための被処理物保持手段を有すると共に、前記押圧部に保持された前記被処理物の一部を、前記筒状回転体が駆動回転している際に前記筒状回転体の内包空間の外部に排除するための被処理物排除手段を有している粉体処理装置。

【請求項２】　前記被処理物保持手段を、前記筒状回転体の上下縁のうち少なくとも何れか一方に設け、かつ、前記回転軸心の側に折れ曲がった折曲り部によって構成してある請求項１に記載の粉体処理装置。

【請求項３】　前記被処理物排除手段を、前記折曲り部に形成した切欠部で構成してある請求項２に記載の粉体処理装置。

【請求項４】　前記被処理物排除手段を、前記受け面に貫通形成した孔部で構成してある請求項１に記載の粉体処理装置。

【請求項５】　前記孔部を略半円形状に構成すると共に、前記受け面の最下部に設けてある請求項４に記載の粉体処理装置。

【請求項６】　前記孔部をスリット状に構成すると共に、鉛直方向に沿った当該孔部の長さを、同方向における前記受け面の高さと略同じに形成してある請求項４に記載の粉体処理装置。

【請求項７】　前記孔部を、前記回転軸心を中心とした周方向に複数形成してある請求項４～６の何れかに記載の粉体処理装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、鉛直方向に沿った回転軸心の回りに回転自在であり、被処理物が押し付けられる受け面を内周部に有する筒状回転体と、前記受け面に近接するよう前記筒状回転体の内部に配置したインナーピースとを備えた粉体処理装置に関する。

【０００２】

【従来の技術】従来、この種の粉体処理装置としては、例えば、被処理物を処理するための処理空間を形成する筒状回転体を設けておき、当該筒状回転体を回転駆動して被処理物を前記筒状回転体の内周部に形成した受け面に押し付けつつ、前記筒状回転体の内部に設けたインナーピースを用いて、前記受け面と前記インナーピースとの協働によって粉粒体に押圧力あるいはせん断力を付与するものがあった。当該従来の装置によって、被処理物である例えば粉粒体どうしの粗混合や複合化の他、精密混合あるいは粉粒体の形状制御等の各種処理を行っていた。このうち特に、複合化とは、複数の原料を混ぜ合わせたものに加圧力およびせん断力を加えて特定の原料の表面に他の原料を融合し、一体化することをいう。また、精密混合とは、異種の原料を単一粒子レベルで均一に分散させた状態に混合することをいう。さらに、形状制御とは、例えば、複数の原料に加圧力あるいはせん断力を作用させて、球状を有しない特定の原料の表面に他の原料を付着させ、当該特定の原料を球状に整形すること等をいう他、球状を有しない原料に加圧力等を作用させてその一部を破砕し、当該原料を球状に整形すること等をいう。尚、これらの処理を総称してメカノフュージョン処理という場合もある。

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【０００３】

【発明が解決しようとする課題】上記従来の装置では、粉体を処理する毎に筒状回転体の内部に被処理物である粉体を所定量だけ投入する所謂バッチ処理を行っていた。よって、被処理物の処理能力に一定の制限があった。また、被処理物は前記筒状回転体の受け面に固着して完全に処理されないものが残存する等、品質が安定した製品を得ることが困難であった。さらに、上記のごとくバッチ処理を行うものであったから、被処理物の投入・取出し操作あるいは装置の洗浄が煩雑であり、処理空間内部の雰囲気制御も困難である等多くの改良すべき点を有していた。

【０００４】本発明の目的は、上記従来の問題点を解消し、被処理物の処理能力および操作性に優れた粉体処理装置を提供することにある。

【０００５】

【課題を解決するための手段】〔構成１〕本発明の粉体処理装置は、請求項１に示すごとく、受け面６とインナーピース５との間に形成する押圧部７に被処理物４を保持するための被処理物保持手段Ｓ１を有すると共に、前記押圧部７に保持された前記被処理物４の一部を、前記筒状回転体３が駆動回転している際に前記筒状回転体３の内包空間３ａの外部に排除するための被処理物排除手段Ｓ２を有している点に特徴を有する。

〔作用効果〕本構成のごとく、受け面とインナーピースとの間に被処理物保持手段を設けておけば、押圧部に被処理物を確実に保持して被処理物に押圧力を付与するから、被処理物の処理効率を向上させることができる。また、前記押圧部に保持された被処理物の一部は、筒状回転体が駆動回転している最中に、被処理物排除手段によって筒状回転体の内包空間の外部に排除される。つまり、押圧部の被処理物が順次入れ替えられ、装置の内部に投入した被処理物の全体が均等に処理される結果、得られる製品の品質が極めて安定したものとなる。さらに、本発明の装置では、筒状回転体の内包空間でけでなく筒状回転体の外部にも被処理物を貯溜することができる。このため、一回のバッチ処理に際して従来の粉体処理装置よりも多量の被処理物を装置の内部に投入するこ

とができ、被処理物の処理効率をさらに向上させることができる。

【０００６】〔構成２〕本発明の粉体処理装置は、請求項２に示すごとく、前記被処理物保持手段Ｓ１を、前記筒状回転体３の上下縁のうち少なくとも何れか一方に設け、かつ、前記回転軸心Ｘの側に折れ曲がった折曲り部２１によって構成することができる。

〔作用効果〕インナーピースによって受け面の側に押圧された被処理物は、例えば受け面の上方側あるいは下方側に移動して押圧部の外部に逃げようとする。被処理物のこのような動きを上記折曲り部により拘束することで、被処理物が押圧部に滞在する時間を増大させ、粉体処理の効率をより向上させることができる。

【０００７】〔構成３〕本発明の粉体処理装置は、請求項３に示すごとく、前記被処理物排除手段Ｓ２を、前記折曲り部２１に形成した切欠部２４で構成することができる。

〔作用効果〕上述したごとく、インナーピースによって押圧された被処理物は受け面の上方側あるいは下方側に移動しようとする。よって、前記折曲り部に切欠部を形成しておき、被処理物の上記移動を一部許容することで、押圧部に存在する被処理物を順次入れ替えることができ、被処理物の全体を均等に処理することができる。

【０００８】〔構成４〕本発明の粉体処理装置は、請求項４に示すごとく、前記被処理物排除手段Ｓ２を、前記受け面６に貫通形成した孔部２０で構成することができる。

〔作用効果〕筒状回転体は高速で回転するから、押圧部に存在する被処理物には強い遠心力が作用する。同時に、押圧部の被処理物にはインナーピースによる外方への押圧力も作用する。よって、本構成のごとく前記受け面に孔部を貫通形成しておけば、被処理物は筒状回転体の外方に容易に移動して被処理物の排除が非常に円滑に行われる。この結果、押圧部に存在する被処理物の入れ替えが速やかに且つ確実に行われて、被処理物の処理速度が向上し、製品の品質がさらに安定する。

【０００９】〔構成５〕本発明の粉体処理装置は、請求項５に示すごとく、前記孔部２０を略半円形状に構成すると共に、前記受け面６の最下部に設けておくことができる。

〔作用効果〕押圧部に存在する被処理物には前述のごとく遠心力とインナーピースによる押圧力とが作用するが、その他に重力も作用する。よって、例えば被処理物が非常に流動性に富んでいる場合には、押圧部のうちでも特に下方側に流動し易い。そこで、本構成のごとく前記孔部を略半円形状に構成し、前記受け面の最下部に設けておけば、押圧部の下方側に存在する被処理物をより多く排除することができる。しかも、本構成であれば、受け面に直に接触している被処理物ほど先に筒状回転体の外部に排除されるから、従来装置のごとく、一旦受け面に固着した被処理物は最後まで未処理のままで残存するという不都合は生じない。よって、押圧部に存在する被処理物の入れ替え効果がさらに向上して、粉体処理の処理効率が改善されるのである。

【００１０】〔構成６〕本発明の粉体処理装置は、請求項６に示すごとく、前記孔部２０をスリット状に構成すると共に、鉛直方向に沿った当該孔部２０の長さを、同方向における前記受け面６の高さと略同じに形成することができる。

〔作用効果〕本構成のごとく、鉛直方向に沿って受け面の高さと略同等の長さを有するスリットを設けておけば、押圧部のうち鉛直方向に沿った何れの位置においても、略同じ量の被処理物を排除することが可能となる。よって、例えば、被処理物の流動性が非常に乏しく、前記受け面の略全体に被処理物が付着するような場合でも、被処理物の入れ替えを確実に行うことができ、粉体処理の処理効率を向上させることができる。

【００１１】〔構成７〕本発明の粉体処理装置は、請求項７に示すごとく、前記孔部２０を、前記回転軸心Ｘを中心とした周方向に複数形成しておくことができる。

〔作用効果〕本構成のごとく、前記孔部の数を任意に設定することで、押圧部に存在する被処理物の排除量を適宜設定することができる。例えば、孔部の数を多くするほど被処理物は容易に排除されるから、インナーピースによって付与する押圧力が結果的に弱まることとなる。即ち、粉体処理が速やかに進行する被処理物を扱う場合、あるいは、過大な押圧力を与えたくない被処理物を処理する場合等には、前記孔部を多く設けるのが好ましい。このように、本構成であれば、被処理物の特性に応じた粉体処理を行うことができる。

【００１２】尚、上述のように、図面との対照を便利にするために符号を記したが該記入により本発明は添付図面の構成に限定されるものではない。

【００１３】

【発明の実施の形態】以下に本発明の実施の形態を図面に基づいて説明する。尚、図面において従来例と同一の符号で表示した部分は、同一又は相当の部分を示している。

【００１４】（概要）本発明の粉体処理装置を図１に示す。本発明の装置は、主に、基台１に設置した略円筒形状のケーシング２、および、当該ケーシング２の内部に設けた同じく略円筒形状の筒状回転体３、当該筒状回転体３との間に押圧力を発生させて被処理物４を処理すべく前記筒状回転体３の内部に配設したインナーピース５とからなる。前記被処理物４は、通常、粉体状の原料を用いるが、スラリー原料や懸濁液状の原料を用いることも可能である。前記筒状回転体３を回転させることで、当該筒状回転体３の内周面に形成した受け面６と前記インナーピース５とを相対回転させ、前記受け面６と前記インナーピース５との間の押圧部７に存在する被処理物

４に押圧力を付与して粉体処理を行うものである。

【００１５】本発明の装置においては、被処理物４の処理効率を向上させるための被処理物保持手段Ｓ１を備えており、当該被処理物保持手段Ｓ１によって被処理物４をできるだけ前記押圧部７に保持する構成となっている。また、その一方で、前記押圧部７に対して被処理物４を積極的に循環させるための被処理物排除手段Ｓ２を有している。この被処理物排除手段Ｓ２は、前記押圧部７に保持された被処理物４の一部を、筒状回転体３が駆動回転されている最中に筒状回転体の内包空間３ａの外部に排除するものであり、これにより、全ての被処理物４が前記押圧部７に対して順次循環供給されるのである。

【００１６】（ケーシング）本装置を構成するケーシング２は、基台１に載置固定した支持部材８によって支持されている。当該ケーシング２の内部には、被処理物４を処理するための処理空間９が形成される。当該ケーシング２はケーシング本体２ａと蓋部材２ｂとからなる。前記蓋部材２ｂは、ケーシング本体２ａに対して着脱自在であり、被処理物投入口１０及びフィルター付き排気口１１を有している。前記ケーシング本体２ａの底部周縁の一部には処理が終了した被処理物４を取り出すための被処理物取出口１２を形成してある。これらの構成により、被処理物４の連続処理が可能である。尚、ケーシング２の底部２ｃは、外周部ほど下方に位置するように略円錐状に傾斜させてある。これは、ケーシング２の底部２ｃに移行した被処理物４が、後述する筒状回転体３の回転軸部１４と当該底部２ｃとの隙間に侵入して筒状回転体３の回転が阻害されるのを防止するためである。

【００１７】前記ケーシング２の内部、即ち、前記処理空間９の雰囲気は、被処理物４の種類等に応じて適宜変更することができる。例えば、不活性ガスや加熱ガス等の各種のガスを前記被処理物投入口１０からケーシング２の内部に投入することができるし、加圧・真空ポンプ等を用いてケーシング２の内部を加減圧することも可能である。そのため、本発明に係る粉体処理装置では、例えば、ケーシング２と筒状回転体３の回転軸部１４との間、あるいは、ケーシング２とインナーピース５の縦向き固定軸２２との間にシール部材２７ａ，２７ｂを設けてある。

【００１８】前記ケーシング２の周囲には、主に前記処理空間９の温度を調節するためのジャケット１３を設けてある。当該ジャケット１３へは、別に設けたタンク（図外）からの加熱媒体又は冷却媒体が必要に応じて循環供給される。勿論、前記ケーシング２の内部温度を積極的に調節する必要がない場合には、加熱媒体などの供給は行わない。

【００１９】（筒状回転体）図１に示すごとく、前記ケーシング２の内部には、略円筒形状であって鉛直方向の回転軸心Ｘの回りに回転自在な筒状回転体３を備えている。当該筒状回転体３は、例えば、回転軸部１４と当該回転軸部１４に連接した底部１５、及び、当該底部１５に連接した円筒壁部１６とで構成してある。

【００２０】前記回転軸部１４は軸受１７を介して回転自在に基台１に取り付けられている。基台１に取り付けられたモータ１８および当該モータ１８に連結された駆動ベルト１９-ａによって、前記回転軸部１４のプーリー１９ｂに駆動力が伝達され、前記筒状回転体３が回転駆動される。筒状回転体３を回転駆動することで被処理物４には遠心力が作用し、被処理物４は筒状回転体３の受け面６に押し付けられるのである。

【００２１】前記底部１５は、前記回転軸部１４と前記円筒壁部１６とを連結する機能、および、前記被処理物保持手段Ｓ１としての機能を有する。即ち、当該底部１５は、後述する円筒壁部１６との関係において互いの面が折れ曲がった関係にあり、筒状回転体３が回転する際に、被処理物４が充分に処理されずに押圧部７から下方に逃げてしまうのを防止する。

【００２２】前記円筒壁部１６の内周面は、遠心力を受けて外向きに移動しようとする被処理物４の受け面６となる。即ち、被処理物４を前記押圧部７に留めておき、前記受け面６と前記インナーピース５との協働によって被処理物４に押圧力を付与して粉体処理を行う。

【００２３】この円筒壁部１６には、図１あるいは図２に示すごとく孔部２０を設けてある。この孔部２０は、前記受け面６、つまりは前記円筒壁部１６を貫通しており、円筒壁部１６の回転軸心Ｘを挟んで対称の位置に合計二個所設けてある。前記孔部２０は、前記押圧部７に保持された被処理物４の一部を押圧部７の外部に排除するためのものであり、前記被処理物排除手段Ｓ２として機能する。当該孔部２０は、例えば受け面６の下方側に保持された被処理物４ほど多く排出するように下方側の開口面積の比率が大きくなるように形成してある。本実施形態では、例えば、前記孔部２０を半円形状に形成する。被処理物４は、遠心力によって前記受け面６に押し付けられつつ、同時に重力の影響を受ける。このため、図１に示す円筒壁部１６の場合、被処理物４は鉛直方向下方へ移動して前記受け面６と前記底部１５との境界近傍に堆積しがちとなる。この部分に堆積する被処理物４は、筒状回転体３の回転負荷を増大させると共に、前記押圧部７への被処理物４の循環を阻害する。よって、当該部分に堆積した被処理物４を積極的に排除することで上記不都合を解消し、粉体処理の効率を向上させるのである。

【００２４】尚、通常、被処理物４は上記のごとく下方に移動するが、インナーピース５の押圧力が強い場合には、前記押圧部７に存在する被処理物４が前記受け面６の上方に押し上げられることとなる。この場合に、上方への被処理物４の移動を一切制限しないとすると、被処理物４に与える押圧力が一定以上に高まらず、粉体処理

の効率が制限される。そこで、本実施形態においては、前記筒状回転体３の上縁にも前記被処理物保持手段Ｓ１としての折曲り部２１を設ける例を示した。本構成によれば、前記押圧部７に存在する被処理物４の殆どが前記孔部２０を介して押圧部７の外に排除される。よって、被処理物４は一定時間のあいだ押圧部７に保持されて押圧力を付加され粉体処理が確実に行われる。

【００２５】（インナーピース）前記筒状回転体３の内部には、前記受け面６に所定の間隔を有して配置するインナーピース５を設けている。当該インナーピース５は、例えば、前記筒状回転体３の回転軸心Ｘと同軸心上となるように設けた縦向き固定軸２２に固設してある。当該インナーピース５は、前記受け面６と協働して被処理物４に押圧力を付与する。そのため、インナーピース５の水平断面形状は、図３に示すごとく例えば半円形状に構成してある。本構成であれば、当該インナーピース５と前記受け面６との間に侵入しようとする被処理物４を圧密する効果が期待できるため、粉体粒子の複合化や球状化処理には有利である。このインナーピース５はケーシング２と同様に固定した構成としてもよいし、前記縦向き固定軸２２を何らかの駆動手段を用いて回転駆動し、前記受け面６に対して積極的に相対回転させる構成にしてもよい。即ち、インナーピース５の回転方向あるいは回転速度を適宜設定することで、当該インナーピース５と前記受け面６との相対回転速度をより細かく設定できて、被処理物４に応じた最適な処理条件を設定することが可能となる。

【００２６】図示は省略するが、前記縦向き固定軸２２が固定してある場合あるいは回転駆動できる場合の如何に拘わらず、前記縦向き固定軸２２を介して前記インナーピース５の温度を制御する構成とすることもできる。例えば図示は省略するが、縦向き固定軸２２およびインナーピース５の内部に熱媒体通路を確保しておけば、被処理物４の熱特性に応じて最適な処理条件を設定することが容易となる。

【００２７】（羽根部材）前記ケーシング２の外周下方部には羽根部材２３を設けてある。当該羽根は、筒状回転体３の周方向に沿って復数枚設けるが、その枚数は任意である。当該羽根部材２３は、前記孔部２０から筒状＊回転体３の外方に排除された被処理物４を再び前記押圧部７に循環させるためのものである。この羽根部材２３は、前記被処理物４を前記押圧部７に円滑かつ確実に搬送するために、前記ケーシング２の内面形状に適合させて形成してある。

【００２８】（粉体処理）本発明に係る装置を用いた場合、被処理物４が遠心力によって筒状回転体３の受け面６に押し付けられ、集合作用を受けて、受け面６において圧密状態の被処理物４層が生成する。その一方で、当該圧密された被処理物４の一部は、前記孔部２０等で構成した被処理物排除手段Ｓ２を介して筒状回転体３の外側に排除されるし、筒状回転体３の内部に存在する被処理物４は、前記インナーピース５によってある程度の撹拌作用を受ける。即ち、本発明の装置によれば、被処理物４の複合化および混合化を速やかに進行させることができる。

【００２９】（効果）以上のごとく、本発明の粉体処理装置によれば、前記押圧部７と筒状回転体３の外部空間とを被処理物４が循環し、押圧部７には被処理物４が順次入れ替わって供給されるから、被処理物４の全体を確実に粉体処理して品質が極めて安定した製品を得ることができ、しかも、従来の装置に比べて被処理物４の処理能力が大幅に向上する。また、本発明の装置では、筒状回転体の内包空間だけでなく筒状回転体の外部にも被処理物を貯溜することができるため、一回のバッチ処理に際して従来の粉体処理装置よりも多量の被処理物を装置の内部に投入することができ、被処理物の処理効率をさらに向上させることができる。さらには、本発明の装置によれば、受け面６に対する被処理物４の付着量は被処理物排除手段Ｓ２の働きによって大幅に低減されるから、当該装置の動作不良が発生し難く、清掃等の手間も軽減される。

【００３０】（実施例）本発明の装置を用いた粉体処理の一例を以下に示す。実験試料として、珪砂と酸化チタンとを重量比で１０：１に配合したものを用いた。これらの試料の物性を表１に示す。

【００３１】

【表１】

実験試料の物性値

試　料	珪　砂	酸化チタン
かさ密度　kg/m³	0.81 × 10³	0.31 × 10³
５０%粒径　μm	21.9	0.015
BET比表面積　m²/g	0.63	116

【００３２】ここでＢＥＴ比表面積とは、吸着法の一種であるＢＥＴ法によって測定した試料の比表面積をい

う。即ち、試料粉体の表面に吸着占有面積が既知である分子を吸着させ、その吸着量から試料の比表面積を求めるものである。当該実施例の運転条件を表２に示す。

＊【００３３】

【表２】

実験試料の物性値

筒状回転体の回転数 rpm	2000, 3000, 3500
試料投入量 kg	1.26(10倍), 2.52(20倍), 5.04(40倍) (従来の標準型装置の試料投入量は0.126kg)
処理時間 min	30, 60, 120, 180, 240, 300

【００３４】尚、本実施例においては、回転筒体の内周径は１５０ｍｍφであり、受け面６とインナーピース５とのクリアランスは５ｍｍとした。受け面６の高さは１００ｍｍであり、インナーピース５の高さは８０ｍｍである。筒状回転体３には被処理物排除手段Ｓ２として、前記受け面６の最下部に略半円形状の孔部２０を設けた。当該孔部２０の高さは１０ｍｍとし、底辺部の幅は４５ｍｍとした。

【００３５】本実施例の結果を図４に示す。本図は、処理時間とＢＥＴ比表面積との関係を示すものであり、筒状回転体３の回転数は２０００ｒｐｍに固定して試料の投入量を変化させた結果を整理した。図４により処理時間の経過と共にＢＥＴ比表面積が減少していることがわかる。これは、珪砂の表面に酸化チタンが融合して粉体粒子の複合化が生じていることを示すものである。この結果では、試料の投入量を１．３８ｋｇから５．５４ｋｇまで増加させても粉体どうしの融合の進行程度は安定していることがわかる。即ち、試料の投入量の多少に拘わらず、安定的に複合化処理が進行することがわかる。図５には、筒状回転体３の回転数が処理速度に与える影響を示した。ここでは、従来の標準型装置に係る処理量の２０倍の試料を投入している。筒状回転体３の回転数が多いほど処理速度も向上することがわかる。例えば、筒状回転体３の回転数が３５００ｒｐｍの場合には、従来の標準型装置の処理量に対して処理時間を約２倍に延長することで従来の約２０倍の試料を処理できることがわかる。

【００３６】〔別実施形態〕以下に他の実施の形態を説明する。

〈１〉　上記実施形態では、被処理物排除手段Ｓ２を半円形状の孔部２０で構成したが、当該構成に限られるものではなく、図６に示すごとくスリット状の孔部２０ａを構成することとしても良い。例えば、本別実施形態の場合には鉛直方向に沿って受け面６の高さと略同等の長さを有する孔部２０ａを設けておく。本構成であれば、押圧部７のうち鉛直方向に沿った何れの位置においても、略同じ量の被処理物４を回転中の筒状回転体３の外部に排除することが可能となる。よって、例えば、被処理物４の流動性が比較的乏しく、前記受け面６の略全体に被処理物が付着するような場合でも、被処理物４の入れ替えを確実に行うことができ、当該粉体処理の効率を向上させることができる。

【００３７】〈２〉　上記実施形態では、被処理物排除手段Ｓ２を孔部２０で構成したが、当該構成に限られるものではなく図７に示すごとく、前記折曲り部２１に切欠部２４を形成するものとしても良い。当該切欠部２４は、例えば、図７（イ）に示すごとく筒状回転体３の上下に鍔状に設けた折曲り部２１に対して設けるものとし、上側の折曲り部２１および下側の折曲り部２１の夫々において前記回転軸心Ｘの周方向に分散させて複数箇所に設けるものとする。本構成であれば、筒状回転体３の回転に際して重力によって下方に移動しようとする被処理物４の動きを利用して被処理物４を循環させることが可能であり、全ての被処理物４を効率的に粉体処理することができる。尚、図７（ロ）に示すごとく、筒状回転体３の底部１５の周縁部に対し、複数箇所に孔部２４ａを設けることで上記切欠部２４と同様の効果を発揮させることもできる。

【００３８】〈３〉　上記実施形態では、断面形状が略円筒状の外周面を有するインナーピース５を用いたが、この他にも、図８（イ）に示すごとく略矩形状の断面形状を有するものや、図８（ロ）に示すごとく台形状の断面形状を有するもの、さらには、図８（ハ）に示すごとく完全な円筒状の外面を有するものなど各種の形状のものを用いることが可能である。これらのうち、外面が略円筒状に形成されているものでは、被処理物４を受け面６との間で押圧するので、所謂粉体処理を行うのに好都合である。これに対して、断面が矩形状あるいは台形状のものでは、被処理物４を押圧するというよりも受け面６に付着した被処理物４を剥離させる効果が高まるため、被処理物４を精密混合したりする場合に有利である。

【００３９】〈４〉　前記筒状回転体３の形状としては種々のものが考えられる。例えば、図９（イ）に示すごとく前記受け面６の上側を縮径させるものであってもよい。この場合には、被処理物４に作用する遠心力の分力

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によって被処理物４をより積極的に下方に移動させることができるので、例えば、粘性の高い被処理物４あるいは比重の小さい被処理物４等を処理するのに適している。また、図９（ロ）に示すごとく前記受け面６の下側を縮径させるものとしてもよい。この場合には、被処理物４に作用する遠心力の分力によって被処理物４の落下を抑制することができるので、比重の大きい被処理物４を処理するのに適している。さらに、図９（ハ）に示すごとく前記受け面６の上下双方の縁部を縮径させた樽形状とするものであってもよい。本構成であれば、筒状回転体３の回転速度が大きくなっても被処理物４を前記押圧部７に確実に保持することができる。尚、何れの場合においても、インナーピース５の形状は、前記受け面６の形状に適合させ、両者の間隔が平行となるように構成するのが望ましい。

【００４０】〈５〉　上記実施形態では、筒状回転体３の内部にはインナーピース５のみを設ける例を示したが、図１０に示すごとくインナーピース５に加えて掻取部材２５を設けることもできる。当該掻取部材２５は、前記受け面６に付着した被処理物４層を掻き取るためのものであり、前記受け面６に対して相対回転自在に設ける。例えばこの掻取部材２５は前記縦向き固定軸２２に連結杆２６を介して取り付けるものとする。当該掻取部材２５は前記インナーピース５の回転方向下手に設けておき、インナーピース５で押しつけられた後の被処理物４を掻き取って、受け面６への被処理物４の固着を防止するのである。これにより、前記押圧部７には常に新しい被処理物４が循環供給されて、被処理物４の粉体処理が促進される。この掻取部材２５と受け面６とのクリアランスは通常１ｍｍ程度に設定する。尚、掻取部材２５＊

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＊はインナーピース５の直後に設けてもよいし、前記筒状回転体３の回転軸心Ｘを中心に３０度～４５度程度後方に設置してもよく、設置位置は任意である。ただし、掻取部材２５をインナーピース５の直前に設けると、被処理物４が飛散して前記押圧部７に被処理物４がうまく供給されないので好ましくない。

【図面の簡単な説明】

【図１】本発明の粉体処理装置を示す縦断面図

【図２】孔部を示す説明図

【図３】インナーピースの形状を示す説明図

【図４】被処理物の複合化処理結果を示す説明図

【図５】被処理物の複合化処理結果を示す説明図

【図６】被処理物排除手段の一例を示す説明図

【図７】被処理物排除手段の一例を示す説明図

【図８】別実施形態に係るインナーピースを示す説明図

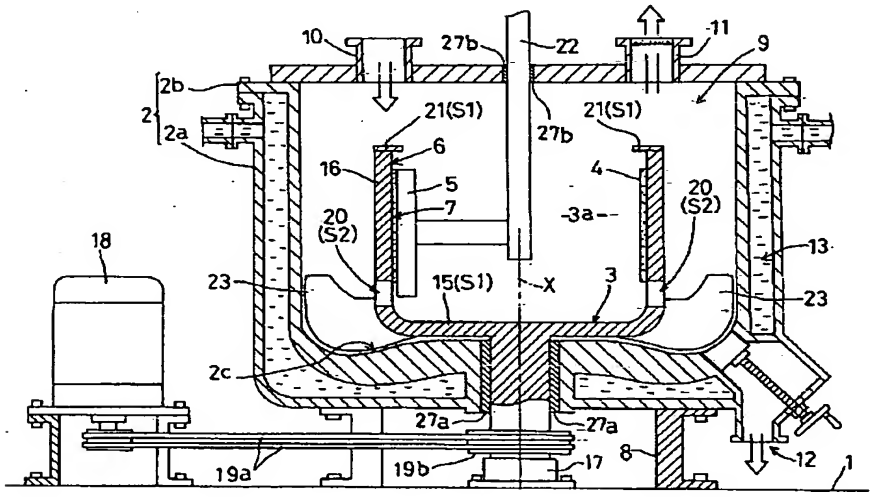
【図９】別実施形態に係る筒状回転体を示す説明図

【図１０】掻取部材を設けた例を示す説明図

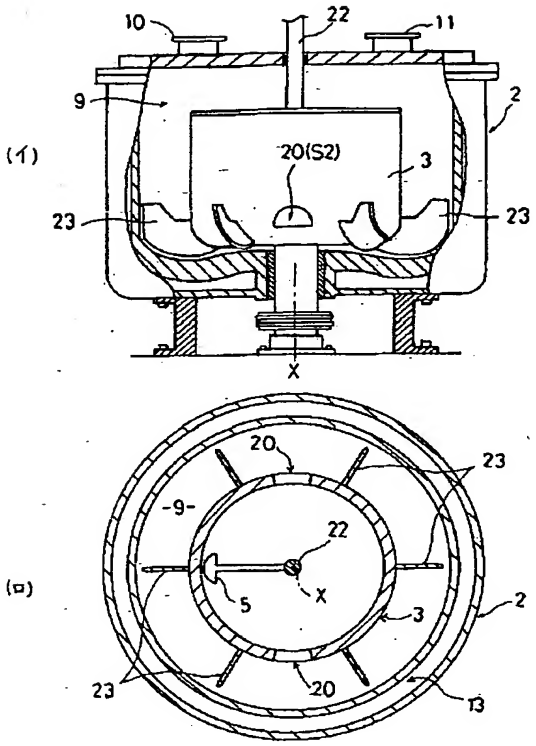
【符号の説明】

３	筒状回転体
３ａ	筒状回転体の内包空間
４	被処理物
５	インナーピース
６	受け面
７	押圧部
２０	孔部
２１	折曲り部
２４	切欠部
Ｓ１	被処理物保持手段
Ｓ２	被処理物排除手段
Ｘ	回転軸心

【図１】



【図２】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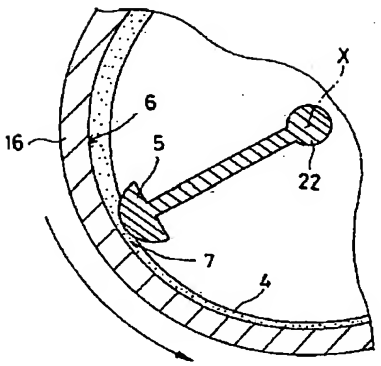
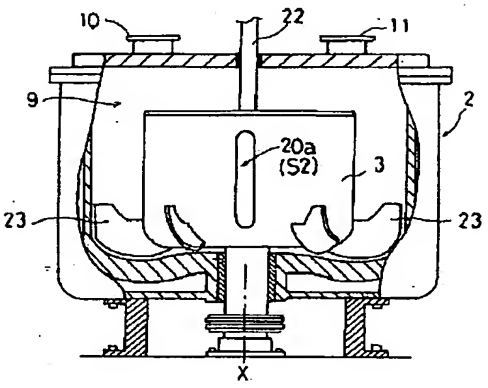
13

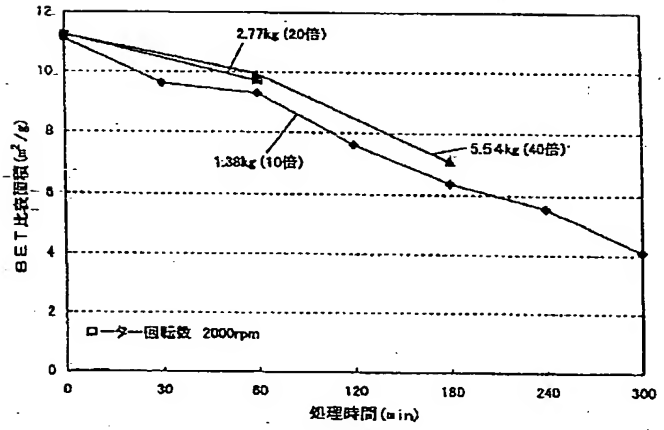
【図３】


X
6
16
5
22
7
4

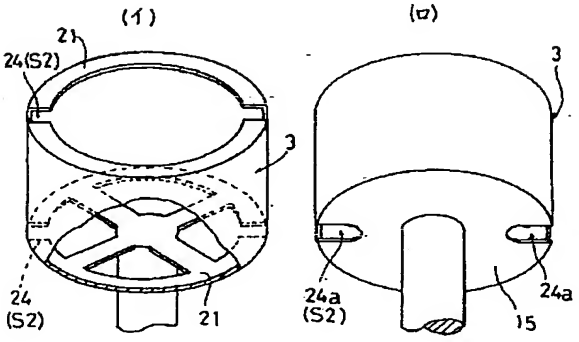
【図６】


10
22
11
9
2
20a
(S2)
3
23
23
X

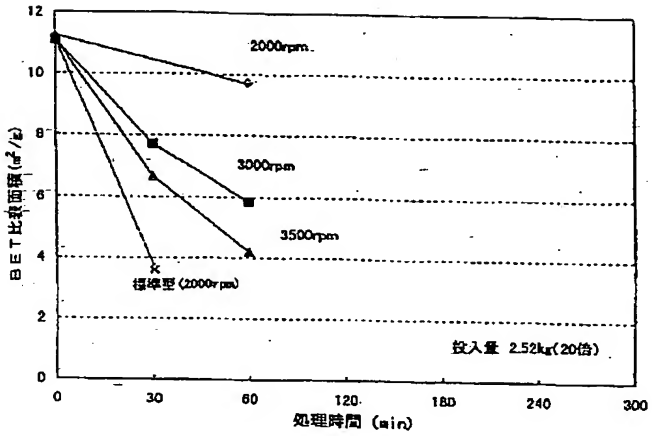
【図４】


12
10
8
6
4
2
0
BET比表面積(m²/g)
2.77kg (20倍)
1.38kg (10倍)
5.54kg (40倍)
ローター回転数 2000rpm
0
30
60
120
180
240
300
処理時間(min)

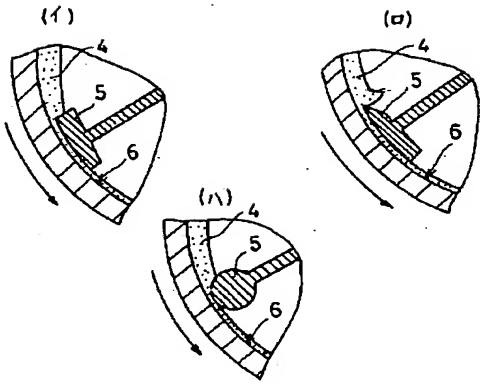
【図７】


(イ)
(ロ)
21
24(S2)
3
3
24
(S2)
21
24a
(S2)
24a
15

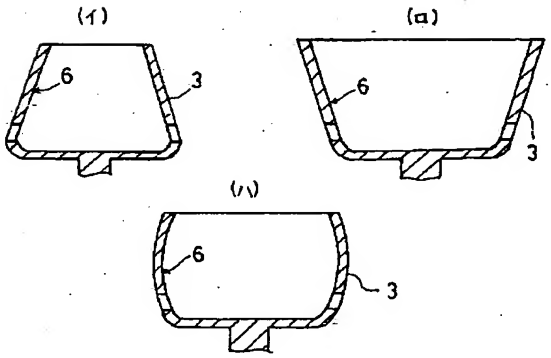
【図５】


2000rpm
3000rpm
3500rpm
標準型(2000rpm)
投入量 2.52kg(20倍)
BET比表面積(m²/g)
処理時間 (min)
0
30
60
120
180
240
300
2
4
6
8
10
12

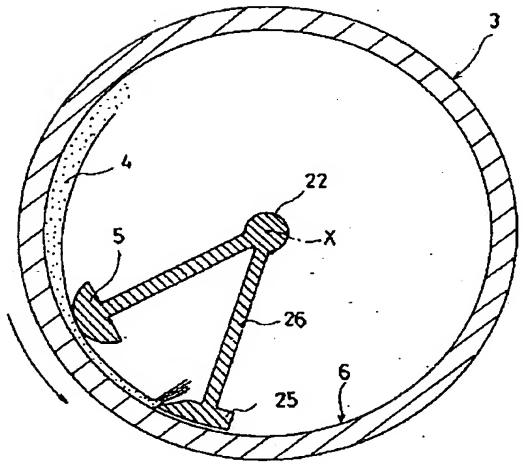
【図８】


(イ)
(ロ)
(ハ)
4
5
6

【図９】


(イ)
(ロ)
(ハ)
6
3

【図１０】


3
4
22
X
5
26
6
25

PATENT ABSTRACTS OF JAPAN

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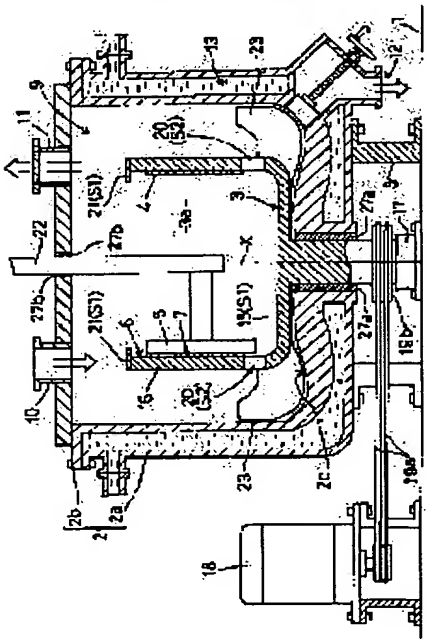
TAKEBAYASHI KENJI

(54) POWER TREATING DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a powder treating device excellent in the treating capacity for a material to be treated and operability.

SOLUTION: This powder treating device is provided with a cylindrical rotor 3 freely rotatable around the rotary axis X along the vertical direction and having a receiving surface 6, to which the material 4 to be treated is pressed, on the inner peripheral part and an inner piece 5 disposed inside the cylindrical rotor 3 to be adjacent to the receiving surface 6 and has a treating material holding means S1 for holding the material to be treated 4 on a pressing part 7 formed between the receiving surface 6 and the inner piece 5 and treating material discharge means S2 for discharging a part of the material 4 to be treated held on the pressing part 7 to the outside part of an included space 3a in the cylindrical rotor 3 when the cylindrical rotor 3 is driven and rotated.

[Claim(s)]

[Claim 1]Have the processed material holding mechanism characterized by comprising the following for holding said processed material to a pressing part which is a granular material processing unit and is formed between said receptacle side and said inner piece, and. A granular material processing unit which has a processed material excluding means for eliminating it to the exterior of intension space of said tubed solid of revolution when said tubed solid of revolution is carrying out the drive revolution of said some of processed materials held at said pressing part.
A tubed solid of revolution which has a receptacle side where it can rotate freely around a shaft center which met in the perpendicular direction, and a processed material is pushed in an inner periphery.
An inner piece arranged inside said tubed solid of revolution so that said receptacle side may be approached.

[Claim 2]The granular material processing unit according to claim 1 constituted by a chip box elbow which provided said processed material holding mechanism in either at least among vertical edges of said tubed solid of revolution, and bent to said shaft center side.

[Claim 3]The granular material processing unit according to claim 2 constituted from a notch which formed said processed material excluding means in said chip box elbow.

[Claim 4]The granular material processing unit according to claim 1 constituted from a pore which carried out penetration formation of said processed material excluding means in said receptacle side.

[Claim 5]The granular material processing unit according to claim 4 which said pore is constituted in approximately semicircle shape, and has been formed in the bottom of said receptacle side.

[Claim 6]height of said receptacle side [in / for the length of the pore concerned which said pore was constituted in slit shape, and met in the perpendicular direction / the direction] -- abbreviated -- the granular material processing unit according to claim 4 currently similarly formed.

[Claim 7]The granular material processing unit according to any one of claims 4 to 6 currently formed in a hoop direction centering on said shaft center in said pore. [two or more]

[Detailed Description of the Invention]

[0001]

[Field of the Invention]It can rotate freely around the shaft center which met in the perpendicular direction, and this invention relates to the granular material processing unit provided with the tubed solid of revolution which has a receptacle side where a processed material is pushed in an inner periphery, and the inner piece arranged inside said tubed solid of revolution so that said receptacle side may be approached.

[0002]

[Description of the Prior Art]As this kind of a granular material processing unit, conventionally, for example, pushing against the receptacle side which provides the tubed solid of revolution which forms the treatment space for processing a processed material, rotated the tubed solid of revolution concerned, and formed the processed material in the inner periphery of said tubed solid of revolution. There were some which give thrust or shearing force to a particulate matter by collaboration with said receptacle side and said inner piece using the inner piece provided in the inside of said tubed solid of revolution. The conventional device concerned was performing various processings which are processed materials, such as rough mixing of for example, particulate matters, precision mixing besides composite-izing, or shape controlling of a particulate matter.Among these, especially composite-ization applies welding pressure and shearing force to what mixed two or more raw materials, unites other raw materials with the surface of a specific raw material, and means unifying. It says that precision mixing mixes a raw material of a different kind in the state where the single particle level was made to distribute uniformly. For example, welding pressure or shearing force is made to act on two or more raw materials with shape controlling, Make other raw materials adhere to the surface of the specific raw material which does not have the shape of a ball, welding pressure etc. are made to act on the raw material which does not have the shape of a ball except that it says operating the specific raw material concerned orthopedically spherically etc., the part is crushed, and it says operating the raw material concerned orthopedically spherically etc. These processings may be named generically and it may be called mechano fusion processing.

[0003]

[Problem(s) to be Solved by the Invention]In the above-mentioned conventional device, whenever it processed the granular material, what is called batch processing by which only the specified quantity throws into the inside of a tubed solid of revolution the granular material which is a processed material was performed. Therefore, the throughput of a processed material had fixed restriction. It was difficult to obtain the product where quality was stabilized for what a processed material adheres to the receptacle side of said tubed solid of revolution, and is not processed thoroughly to remain etc. Since batch processing was performed like the above, it had a point which many -- it is complicated, and an injection and drawing operation of a processed material, or washing of a device is difficult also for the control atmosphere inside treatment space, and it has it -- should improve.

[0004]The purpose of this invention cancels the above-mentioned conventional problem, and

there is in providing the granular material processing unit excellent in the throughput and operativity of a processed material.

[0005]

[Means for Solving the Problem][Composition 1] A granular material processing unit of this invention has the processed material holding mechanism S1 for holding the processed material 4 to the pressing part 7 formed between the receptacle side 6 and the inner piece 5, as shown in claim 1, and. It has the feature at a point of having the processed material excluding means S2 for eliminating it to the exterior of the intension space 3a of said tubed solid of revolution 3 when said tubed solid of revolution 3 is carrying out the drive revolution of said some of processed materials 4 held at said pressing part 7.

[Function and Effect]If processed material holding mechanism is established between the receptacle side and the inner piece like this composition, since a processed material will be certainly held to a pressing part and thrust will be given to a processed material, the processing efficiency of a processed material can be raised. While the tubed solid of revolution is carrying out the drive revolution of some processed materials held at said pressing part, it is eliminated by the exterior of the intension space of a tubed solid of revolution by a processed material excluding means. That is, the processed material of a pressing part is replaced one by one, and as a result of processing uniformly the whole processed material thrown into the inside of a device, the quality of the product obtained becomes the extremely stable thing. In the device of this invention, a processed material can be stored also in the exterior of the tubed solid of revolution instead of ** in the intension space of a tubed solid of revolution. For this reason, on the occasion of one batch processing, a lot of processed materials than the conventional granular material processing unit can be thrown into the inside of a device, and the processing efficiency of a processed material can be raised further.

[0006][Composition 2] As shown in claim 2, the chip box elbow 21 which formed said processed material holding mechanism S1 in either at least among the vertical edges of said tubed solid of revolution 3, and bent to said shaft center X side can constitute the granular material processing unit of this invention.

[Function and Effect]The processed material which won popularity by the inner piece and was pressed at the field side tends to move, for example to the upper part [of a receptacle side], or lower part side, and tends to escape to the exterior of a pressing part. By restraining such a motion of a processed material by the above-mentioned chip box elbow, time for a processed material to stay at a pressing part can be increased, and the efficiency of granular material processing can be raised more.

[0007][Composition 3] The granular material processing unit of this invention can constitute said processed material excluding means S2 from the notch 24 formed in said chip box elbow 21, as shown in claim 3.

[Function and Effect]As mentioned above, the processed material pressed by the inner piece tends to move to the upper part [of a receptacle side], or lower part side. Therefore, the notch is formed in said chip box elbow, by permitting a part of above-mentioned movement of a

processed material, the processed material which exists in a pressing part can be replaced one by one, and the whole processed material can be processed uniformly.

[0008][Composition 4] The granular material processing unit of this invention can constitute said processed material excluding means S2 from the pore 20 which carried out penetration formation in said receptacle side 6, as shown in claim 4.

[Function and Effect]Since a tubed solid of revolution rotates at high speed, a strong centrifugal force acts on the processed material which exists in a pressing part. Simultaneously, the thrust to the method of the outside depended on an inner piece also acts on the processed material of a pressing part. Therefore, if penetration formation of the pore is carried out like this composition in said receptacle side, a processed material will move to a way easily outside a tubed solid of revolution, and exclusion of a processed material will be performed very smoothly. As a result, exchange of the processed material which exists in a pressing part is ensured [promptly and], the processing speed of a processed material improves, and the quality of a product is stabilized further.

[0009][Composition 5] A granular material processing unit of this invention constitutes said pore 20 in approximately semicircle shape, as shown in claim 5, and it can be formed in the bottom of said receptacle side 6.

[Function and Effect]Although a centrifugal force and the thrust by an inner piece act on the processed material which exists in a pressing part like the above-mentioned, gravity also acts. Therefore, for example, especially when the processed material is dramatically rich in mobility, it is easy to flow to the lower part side also among pressing parts. Then, if said pore is constituted in approximately semicircle shape and it provides in the bottom of said receptacle side like this composition, more processed materials which exist in the lower part side of a pressing part can be eliminated. And if it is this composition, since it will be more previously eliminated by the processed material which touches the receptacle side soon in the exterior of a tubed solid of revolution, the inconvenience of remaining while the processed material which once adhered to the receptacle side has been unsettled to the last is not conventionally produced like a device. Therefore, the exchange effect of the processed material which exists in a pressing part improves further, and the processing efficiency of granular material processing is improved.

[0010][Composition 6] the height of said receptacle side [in / for the length of the pore 20 concerned which the granular material processing unit of this invention constituted said pore 20 in slit shape as shown in claim 6, and met in the perpendicular direction / the direction] 6 -- abbreviated -- similarly it can form.

[Function and Effect]winning popularity in accordance with the perpendicular direction like this composition -- the height of a field -- abbreviated -- in which position which met in the perpendicular direction among pressing parts when providing the slit which has equivalent length -- abbreviated -- it becomes possible to eliminate the same quantity of a processed material. Therefore, for example, the mobility of a processed material can be dramatically scarce, even when a processed material adheres to abbreviated [of said receptacle side / whole], exchange of a processed material can be ensured, and the processing efficiency of granular material

processing can be raised.

[0011][Composition 7] The granular material processing unit of this invention can form two or more said pores 20 in the hoop direction centering on said shaft center X, as shown in claim 7.

[Function and Effect]Like this composition, the displacement of the processed material which exists in a pressing part can be suitably set up by setting up the number of said pores arbitrarily. For example, since a processed material is easily eliminated so that the number of pores is increased, the thrust given by an inner piece will become weaker as a result. That is, when granular material processing treats the processed material which runs promptly, or when processing a processed material not to give excessive thrust, it is preferred to provide many said pores. Thus, if it is this composition, granular material processing according to the characteristic of the processed material can be performed.

[0012]As mentioned above, in order to make contrast with a drawing convenient, numerals were described, but this invention is not limited to composition of an accompanying drawing by this entry.

[0013]

[Embodiment of the Invention]An embodiment of the invention is described based on a drawing below. The portion displayed with the same numerals as a conventional example in the drawing shows the same or considerable portion.

[0014](Outline) The granular material processing unit of this invention is shown in drawing 1. the casing 2 of the shape of a cylindrical shape which mainly installed the device of this invention in the pedestal 1 -- and, It consists of the inner piece 5 which was provided in the inside of the casing 2 concerned and which was allocated in the inside of said tubed solid of revolution 3 that thrust is generated and the processed material 4 should similarly be processed between the tubed cylindrical shape-like solid of revolution 3 and the tubed solid of revolution 3 concerned. Although the raw material of powder state is used for said processed material 4, it can also usually use a slurry raw material and a suspension-like raw material. By rotating said tubed solid of revolution 3, relative rotating of the receptacle side 6 formed in the inner skin of the tubed solid of revolution 3 concerned and said inner piece 5 is carried out, thrust is given to the processed material 4 which exists in the pressing part 7 between said receptacle side 6 and said inner piece 5, and granular material processing is performed.

[0015]In the device of this invention, it has the processed material holding mechanism S1 for raising the processing efficiency of the processed material 4, and has the composition of holding the processed material 4 to said pressing part 7 as much as possible by the processed material holding mechanism S1 concerned. On the other hand, it has the processed material excluding means S2 for circulating the processed material 4 positively to said pressing part 7. This processed material excluding means S2 eliminates some processed materials 4 held at said pressing part 7 to the exterior of the intension space 3a of a tubed solid of revolution, while the drive revolution of the tubed solid of revolution 3 is carried out, and thereby, circulation feed of all the processed materials 4 is carried out one by one to said pressing part 7.

[0016](Casing) The casing 2 which constitutes this device is supported by the support member 8

which carried out fixed mounting to the pedestal 1. The treatment space 9 for processing the processed material 4 is formed in the inside of the casing 2 concerned. The casing 2 concerned consists of the casing main body 2a and lid member 2b. Being able to detach and attach said lid member 2b freely to the casing main body 2a, it has the processed material entrance slot 10 and the exhaust port 11 with a filter. The processed material output port 12 for taking out the processed material 4 which processing ended is formed in a part of periphery of a pars basilaris ossis occipitalis of said casing main body 2a. By these composition, the continuous processing of the processed material 4 is possible. The pars basilaris ossis occipitalis 2c of the casing 2 makes approximately conical shape have inclined so that a peripheral part may be located more nearly caudad. This is to prevent rotation of the tubed solid of revolution 3 from the processed material 4 which shifted to the pars basilaris ossis occipitalis 2c of the casing 2 invading into the crevice between the shaft part 14 of the tubed solid of revolution 3 mentioned later, and the pars basilaris ossis occipitalis 2c concerned, and being checked.

[0017]According to the kind of processed material 4, etc., the inside of said casing 2, i.e., the atmosphere of said treatment space 9, can be changed suitably. For example, various kinds of gas, such as inactive gas and heating gas, can be supplied to the inside of the casing 2 from said processed material entrance slot 10, and it is also possible to carry out the pressurization and decompression of the inside of the casing 2 using application of pressure, a vacuum pump, etc. Therefore, in the granular material processing unit concerning this invention, the sealing members 27a and 27b are formed between the casing 2 and the shaft part 14 of the tubed solid of revolution 3, or between the casing 2 and the longitudinal fixed axis 22 of the inner piece 5, for example.

[0018]The jacket 13 for mainly adjusting the temperature of said treatment space 9 is formed in the circumference of said casing 2. To the jacket 13 concerned, circulation feed of the heating medium or cooling medium from the tank (outside of a figure) formed independently is carried out if needed. Of course, when internal temperature of said casing 2 does not need to be adjusted positively, supply of a heating medium etc. is not performed.

[0019](Tubed solid of revolution) As shown in drawing 1, it is a cylindrical shape-like and the inside of said casing 2 is equipped with the tubed solid of revolution 3 which can be freely rotated around the shaft center X of the perpendicular direction.The tubed solid of revolution 3 concerned consists of the pars basilaris ossis occipitalis 15 connected with the shaft part 14 and the shaft part 14 concerned, and the cylindrical wall part 16 connected with the pars basilaris ossis occipitalis 15 concerned, for example.

[0020]Said shaft part 14 is attached to the pedestal 1 via the bearing 17, enabling free rotation. With the driving belt 19a connected with the motor 18 attached to the pedestal 1, and the motor 18 concerned, driving force is transmitted to the pulley 19b of said shaft part 14, and said tubed solid of revolution 3 rotates. A centrifugal force acts on the processed material 4 by rotating the tubed solid of revolution 3, and the processed material 4 is pushed against the receptacle side 6 of the tubed solid of revolution 3.

[0021]Said pars basilaris ossis occipitalis 15 has a function which connects said shaft part 14 and

said cylindrical wall part 16, and a function as said processed material holding mechanism S1. That is, when the pars basilaris ossis occipitalis 15 concerned has the relation in which the mutual field bent in the relation with the cylindrical wall part 16 mentioned later and the tubed solid of revolution 3 rotates, the processed material 4 prevents escaping from the pressing part 7 caudad, without fully being processed.

[0022]The inner skin of said cylindrical wall part 16 turns into the receptacle side 6 of the processed material 4 which is going to move outward in response to a centrifugal force. That is, the processed material 4 is stopped to said pressing part 7, by collaboration with said receptacle side 6 and said inner piece 5, thrust is given to the processed material 4 and granular material processing is performed.

[0023]As shown in drawing 1 or drawing 2, the pore 20 is formed in this cylindrical wall part 16. This pore 20 penetrates said receptacle side 6, the jam has penetrated said cylindrical wall part 16, and a total of two places are established in the symmetrical position across the shaft center X of the cylindrical wall part 16. Said pore 20 is for eliminating some processed materials 4 held at said pressing part 7 to the exterior of the pressing part 7, and functions as said processed material excluding means S2. The pore 20 concerned is formed so that it may discharge mostly [processed material / about four / which was held at the lower part side of the receptacle side 6, for example] and the ratio of the effective area product by the side of a lower part may become large. According to this embodiment, said pore 20 is formed in semicircle shape, for example. A centrifugal force is simultaneously influenced by gravity, the processed material 4 being pushed against said receptacle side 6. For this reason, in the case of the cylindrical wall part 16 shown in drawing 1, the processed material 4 is moving to the perpendicular direction lower part and depositing near the boundary of said receptacle side 6 and said pars basilaris ossis occipitalis 15. The processed material 4 deposited on this portion increases the rotational load of the tubed solid of revolution 3, and it checks circulation of the processed material 4 to said pressing part 7. Therefore, the above-mentioned inconvenience is canceled by eliminating positively the processed material 4 deposited on the portion concerned, and the efficiency of granular material processing is raised.

[0024]Although the processed material 4 moves caudad like the above, when the thrust of the inner piece 5 is strong, the processed material 4 which exists in said pressing part 7 will usually be pushed up above said receptacle side 6. In this case, supposing it restricts no movement of the processed material 4 to the upper part, the thrust given to the processed material 4 will not increase more than fixed, but the efficiency of granular material processing will be restricted. Then, in this embodiment, the example which forms the chip box elbow 21 as said processed material holding mechanism S1 also in the upper limb of said tubed solid of revolution 3 was shown. According to this composition, most processed materials 4 which exist in said pressing part 7 are eliminated besides the pressing part 7 via said pore 20. Therefore, the processed material 4 is held at the pressing part 7 between fixed time, thrust is added, and granular material processing is ensured.

[0025](Inner piece) The inner piece 5 which has and arranges a predetermined interval to said

receptacle side 6 is formed in the inside of said tubed solid of revolution 3. The inner piece 5 concerned is fixed to the longitudinal fixed axis 22 established, for example so that it might become a shaft center [of said tubed solid of revolution 3] X, and coaxial core top. The inner piece 5 concerned collaborates with said receptacle side 6, and gives thrust to the processed material 4. Therefore, the horizontal section shape of the inner piece 5 is constituted in semicircle shape, as shown in drawing 3. Since the effect which carries out consolidation of the processed material 4 which is going to invade between the inner piece 5 concerned and said receptacle side 6 is expectable if it is this composition, it is advantageous to composite-izing and spheroidizing of granular material particles. This inner piece 5 is good also as composition fixed like the casing 2, rotates said longitudinal fixed axis 22 using a certain driving means, and may make it the composition which carries out relative rotating positively to said receptacle side 6. That is, the relative rotating speed of the inner piece 5 concerned and said receptacle side 6 can be more finely set up by setting up suitably the hand of cut or revolving speed of the inner piece 5, and it becomes possible to set up the optimal processing condition according to the processed material 4.

[0026]Although a graphic display is omitted, it can also be considered as the composition which controls the temperature of said inner piece 5 via said longitudinal fixed axis 22 regardless of the case which can be case [a case] or rotated where said longitudinal fixed axis 22 is fixed. For example, although omitted, a graphic display will become easy [setting up the optimal processing condition according to the heat characteristic of the processed material 4], if the heat carrier passage is secured to the inside of the longitudinal fixed axis 22 and the inner piece 5.

[0027](Blade member) The blade member 23 is formed in the periphery lower part of said casing 2. Although several ** provides the shuttlecock concerned along the hoop direction of the tubed solid of revolution 3, the number of sheets is arbitrary. The blade member 23 concerned is for making said pressing part 7 circulate through the processed material 4 eliminated by the way outside the tubed solid of revolution 3 from said pore 20 again. In order to convey said processed material 4 smoothly and certainly to said pressing part 7, this blade member 23 is fitted to the inner surface shape of said casing 2, and is formed.

[0028](Granular material processing) When the device concerning this invention is used, the processed material 4 is pushed against the receptacle side 6 of the tubed solid of revolution 3 by the centrifugal force, and four layers of processed materials of a compaction state generate in the receptacle side 6 in response to a collecting function. The processed material 4 which some of processed materials 4 concerned by which consolidation was carried out are eliminated by the outside of the tubed solid of revolution 3 on the other hand via the processed material excluding means S2 constituted from said pore 20 grade, and exists in the inside of the tubed solid of revolution 3 receives a certain amount of agitation action by said inner piece 5. That is, according to the device of this invention, composite-izing of the processed material 4 and mixing-ization can be advanced promptly.

[0029](EFFECT OF THE INVENTION) According to [like / the above] the granular material processing unit of this invention, the processed material 4 circulates through said pressing part 7

and the outer space of the tubed solid of revolution 3, since the processed material 4 interchanges to the pressing part 7 one by one and is supplied to it, the product which carried out granular material processing of the whole processed material 4 certainly and where quality was stabilized extremely can be obtained, and, moreover, the throughput of the processed material 4 improves substantially compared with the conventional device. Since a processed material can be stored not only in the intension space of a tubed solid of revolution but in the exterior of a tubed solid of revolution in the device of this invention, On the occasion of one batch processing, a lot of processed materials than the conventional granular material processing unit can be thrown into the inside of a device, and the processing efficiency of a processed material can be raised further. According to the device of this invention, since the coating weight of the processed material 4 to the receptacle side 6 is substantially reduced by work of the processed material excluding means S2, it is hard to generate the malfunction of the device concerned, and time and effort, such as cleaning, is also reduced.

[0030](EXAMPLE) An example of granular material processing using the device of this invention is shown below. As an experimental sample, what blended silica sand and titanium oxide with 10:1 by the weight ratio was used. The physical properties of these samples are shown in Table 1.

[0031]

[Table 1]

実験試料の物性値

試　料	珪　砂	酸化チタン
かさ密度　kg/m³	0.81×10^3	0.31×10^3
５０%粒径　μm	21.9	0.015
BET比表面積　m²/g	0.63	116

[0032]A BET specific surface area means here the specific surface area of the sample measured with the BET adsorption method which is a kind of an adsorption process. That is, on the surface of sample powder, an adsorption occupation area makes the molecule which is known adsorb, and calculates the specific surface area of a sample from the amount of adsorption. The operating condition of the example concerned is shown in Table 2.

[0033]

[Table 2]

実験試料の物性値

筒状回転体の回転数 rpm	2000, 3000, 3500
試料投入量 kg	1.26(10倍), 2.52(20倍), 5.04(40倍) (従来の標準型装置の試料投入量は0.126kg)
処理時間 min	30, 60, 120, 180, 240, 300

[0034]In this example, the diameter of inner circumference of a tumbling barrel object is 150mmphi, and the clearance of the receptacle side 6 and the inner piece 5 was 5 mm. The height of the receptacle side 6 is 100 mm, and the height of the inner piece 5 is 80 mm. The pore 20 of approximately semicircle shape was formed in the bottom of said receptacle side 6 as the processed material excluding means S2 at the tubed solid of revolution 3. The height of the pore 20 concerned was 10 mm, and the width of the base part was 45 mm.

[0035]The result of this example is shown in drawing 4. This figure shows the relation between processing time and a BET specific surface area, and the number of rotations of the tubed solid of revolution 3 arranged the result to which it fixed to 2000 rpm and the input of the sample was changed. It turns out that the BET specific surface area is decreasing with progress of processing time by drawing 4. This shows that titanium oxide united on the surface of silica sand, and composite-ization of granular material particles has arisen. In this result, even if it makes the input of a sample increase from 1.38 kg to 5.54 kg, it turns out that the advance grade of fusion of granular materials is stable. That is, it turns out that composite-ized processing advances stably irrespective of some of inputs of a sample. The number of rotations of the tubed solid of revolution 3 showed drawing 5 the influence which it has on processing speed. Here, the 20 times as many sample as the throughput concerning the conventional normalized form device is supplied. It turns out that processing speed also improves, so that there is much number of rotations of the tubed solid of revolution 3. For example, when the number of rotations of the tubed solid of revolution 3 is 3500 rpm, it turns out that about 20 times [over the past] as many samples can be processed by extending processing time twice [about] to the throughput of the conventional normalized form device.

[0036][Another embodiment] Other embodiments are described below.

1 In the above-mentioned embodiment, although the processed material excluding means S2 was constituted from the pore 20 of semicircle shape, it is good also as constituting the slit shape pore 20a, as it is not restricted to the composition concerned and shown in drawing 6. winning popularity in accordance with the perpendicular direction in the case of for example, the Honbetsu embodiment -- the height of the field 6 -- abbreviated -- the pore 20a which has equivalent length is formed. in which position which met in the perpendicular direction among the pressing parts 7 when it was this composition -- abbreviated -- it becomes possible to eliminate to the exterior of the tubed solid of revolution 3 while rotating the same quantity of the processed

material 4. Therefore, for example, the mobility of the processed material 4 can be comparatively scarce, even when a processed material adheres to abbreviated [of said receptacle side 6 / whole], exchange of the processed material 4 can be ensured, and the efficiency of the granular material processing concerned can be raised.

[0037]**2** In the above-mentioned embodiment, although the processed material excluding means S2 was constituted from the pore 20, as it is not restricted to the composition concerned and shown in drawing 7, it is good also as what forms the notch 24 in said chip box elbow 21. the notch 24 concerned is shown in drawing 7 (b), for example -- as -- the upper and lower sides of the tubed solid of revolution 3 -- a collar -- it shall provide to the chip box elbow 21 provided in **, and in each of the upper chip box elbow 21 and the lower chip box elbow 21, the hoop direction of said shaft center X shall be distributed, and it shall provide in two or more places If it is this composition, it is possible to circulate the processed material 4 using a motion of the processed material 4 which is going to move caudad with gravity when rotating the tubed solid of revolution 3, and granular material processing of all the processed materials 4 can be carried out efficiently. As shown in drawing 7 (**), the same effect as the above-mentioned notch 24 can also be demonstrated by forming the pore 24a in two or more places to the edge part of the pars basilaris ossis occipitalis 15 of the tubed solid of revolution 3.

[0038]**3** Although the inner piece 5 which has a peripheral face where sectional shape is approximately cylindrical was used in the above-mentioned embodiment, In addition, it is possible to use the thing of various kinds of shape, such as what has the sectional shape of approximately rectangular shape as shown in drawing 8 (b), what has the sectional shape of trapezoidal shape as shown in drawing 8 (**), a thing which has a perfect cylindrical outside surface further as shown in drawing 8 (**). Since an outside surface receives the processed material 4 and presses between the fields 6 among these by what is formed approximately cylindrical, it is convenient although what is called granular material processing is performed. On the other hand, since the effect that a section makes the processed material 4 which won popularity in the thing of rectangular shape or trapezoidal shape rather than pressed the processed material 4, and adhered to the field 6 exfoliate increases, it is advantageous when carrying out precision mixing of the processed material 4.

[0039]**4** Various things can be considered as shape of said tubed solid of revolution 3. For example, the diameter of said receptacle side 6 upper part may be made to reduce, as shown in drawing 9 (b). In this case, since the processed material 4 can be more positively moved caudad according to the component of a force of the centrifugal force which acts on the processed material 4, it is suitable for, for example, processing the viscous high processed material 4 or processed material 4 grade with small specific gravity. It is good also as a thing which makes the diameter of said receptacle side 6 bottom reduce as shown in drawing 9 (**). In this case, since fall of the processed material 4 can be controlled according to the component of a force of the centrifugal force which acts on the processed material 4, it is suitable for processing the processed material 4 with large specific gravity. It may be considered as the shape of a barrel shape which made the diameter of the edge of both upper and lower sides of said receptacle side

6 reduce as shown in drawing 9 (**). If it is this composition, even if the revolving speed of the tubed solid of revolution 3 becomes large, the processed material 4 can be certainly held to said pressing part 7. It is desirable to constitute so that both interval may become fit the shape of the inner piece 5 to the shape of said receptacle side 6, and parallel [shape] in the case of which.

[0040]**5** Although the above-mentioned embodiment showed the example which forms only the inner piece 5 to the inside of the tubed solid of revolution 3, as shown in drawing 10, in addition to the inner piece 5, the extra jacket member 25 can also be formed. The extra jacket member 25 concerned is for scratching four layers of processed materials adhering to said receptacle side 6, and is provided to said receptacle side 6, enabling free relative rotating. For example, this extra jacket member 25 shall be attached to said longitudinal fixed axis 22 via the connecting lever 26. The extra jacket member 25 concerned is prepared for the hand-of-cut lower part of said inner piece 5, scratches the processed material 4 after being pushed by the inner piece 5, and prevents adherence of the processed material 4 to the receptacle side 6. Circulation feed of the always new processed material 4 is carried out to said pressing part 7 by this, and granular material processing of the processed material 4 is promoted. Popularity is won with this extra jacket member 25, and the clearance with the field 6 is usually set as about 1 mm. The extra jacket member 25 may be formed immediately after the inner piece 5, and may be back installed 30 degrees - about 45 degrees centering on the shaft center X of said tubed solid of revolution 3, and its installed position is arbitrary. However, if the extra jacket member 25 is formed just before the inner piece 5, since the processed material 4 will disperse and the processed material 4 will not be well supplied to said pressing part 7, it is not desirable.

[Brief Description of the Drawings]

[Drawing 1]Drawing of longitudinal section showing the granular material processing unit of this invention

[Drawing 2]The explanatory view showing a pore

[Drawing 3]The explanatory view showing the shape of an inner piece

[Drawing 4]The explanatory view showing the composite-ized processing result of a processed material

[Drawing 5]The explanatory view showing the composite-ized processing result of a processed material

[Drawing 6]The explanatory view showing an example of a processed material excluding means

[Drawing 7]The explanatory view showing an example of a processed material excluding means

[Drawing 8]The explanatory view showing the inner piece concerning another embodiment

[Drawing 9]The explanatory view showing the tubed solid of revolution concerning another embodiment

[Drawing 10]The explanatory view showing the example which provided the extra jacket member

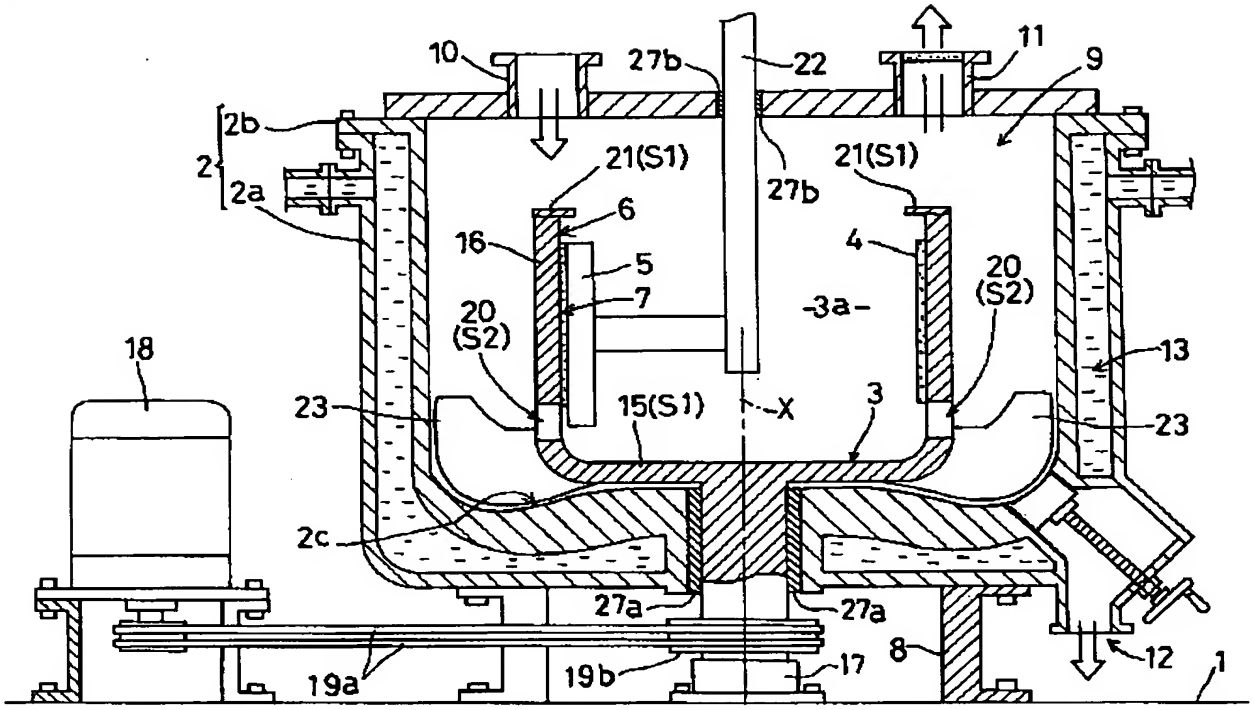
[Description of Notations]

3 Tubed solid of revolution

3a Intension space of a tubed solid of revolution

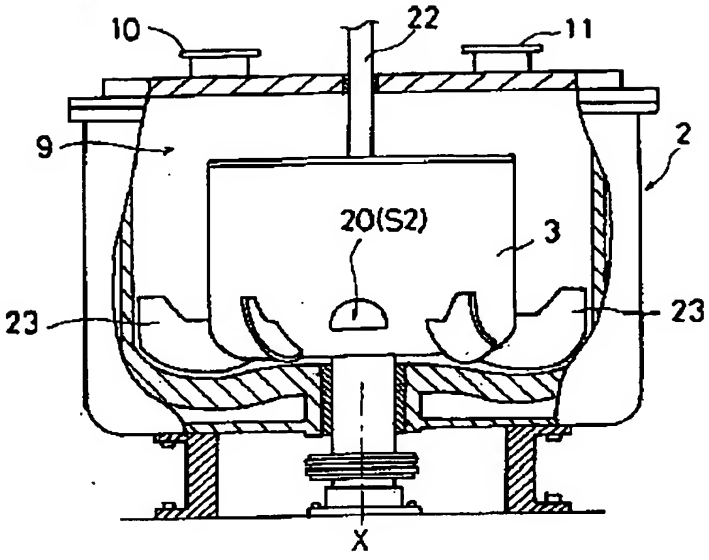
4 Processed material
5 Inner piece
6 Receptacle side
7 Pressing part
20 Pore
21 Chip box elbow
24 Notch
S1 Processed material holding mechanism
S2 Processed material excluding means
X Shaft center

[Drawing 1]



[Drawing 2]

(イ)



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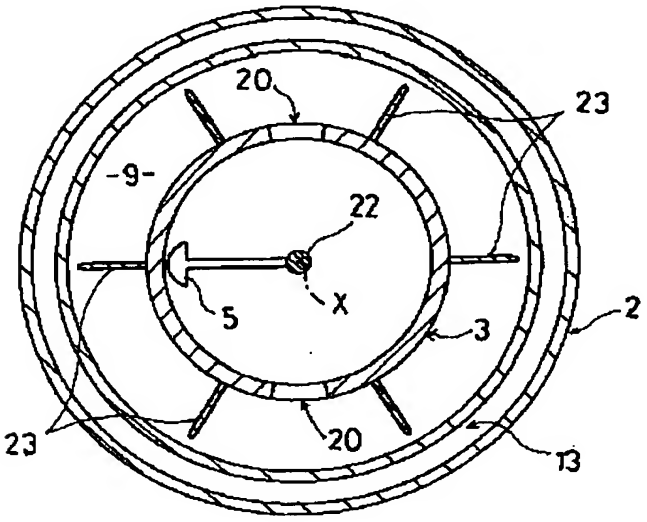
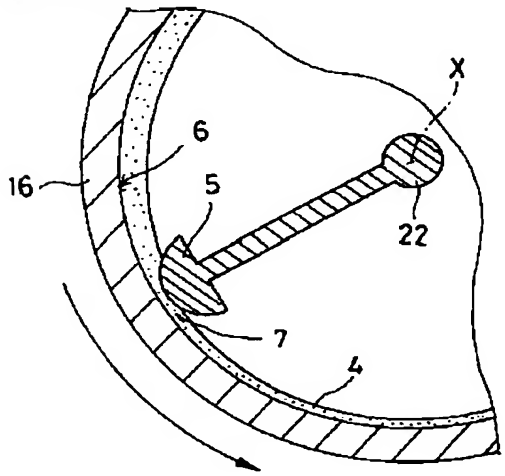
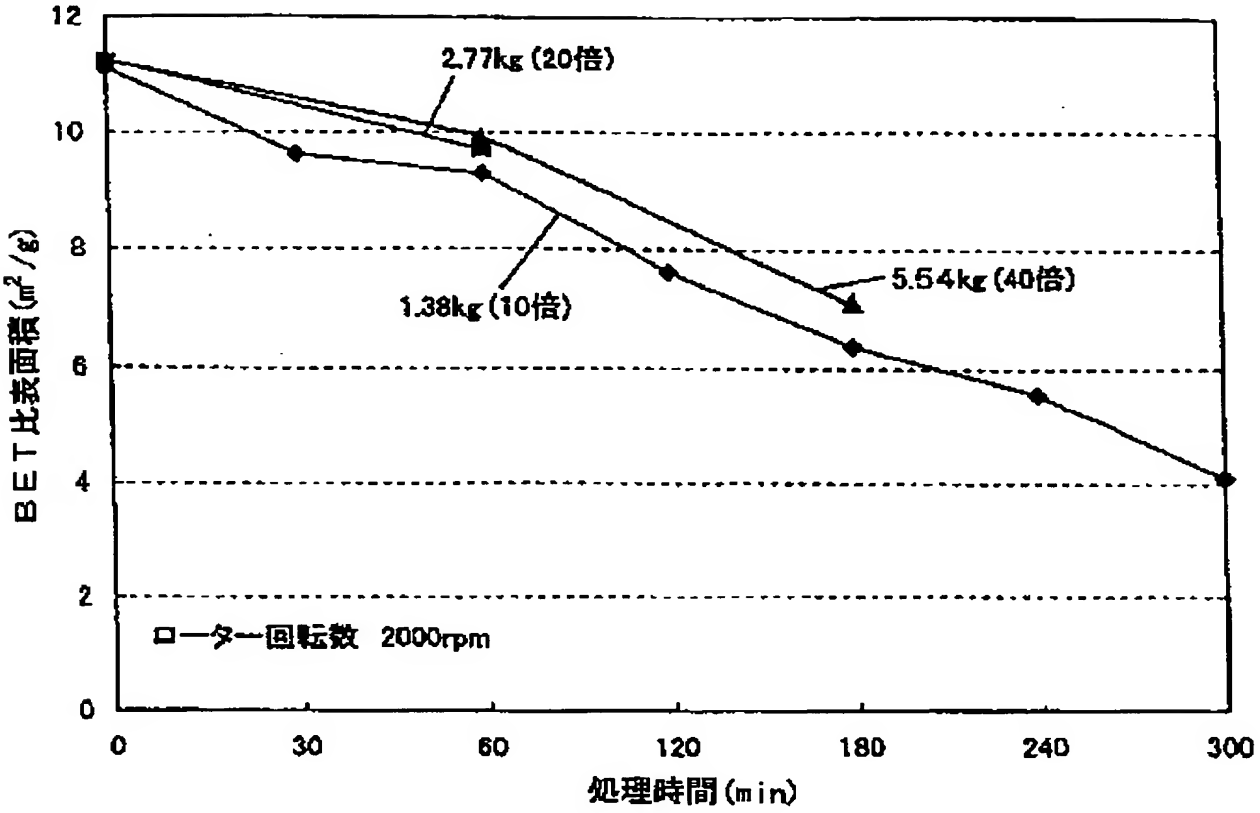


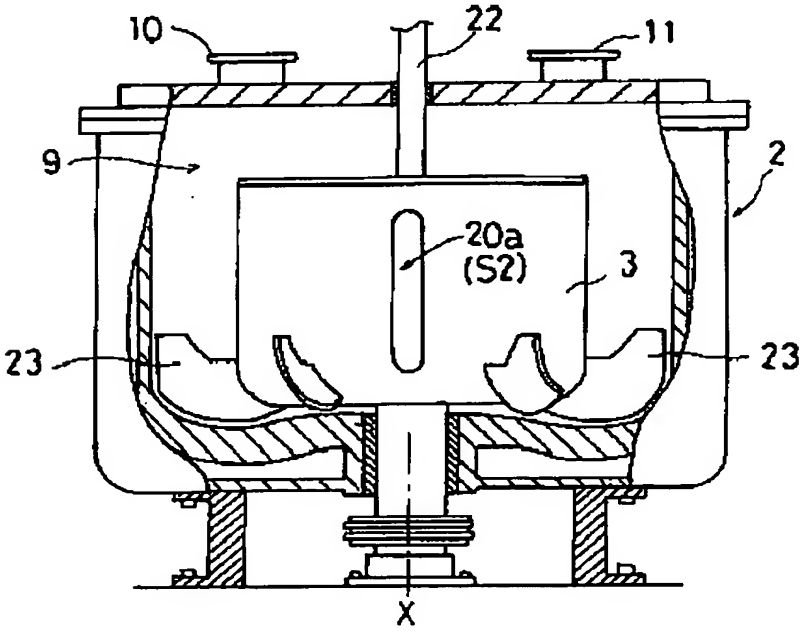
[Drawing 3]



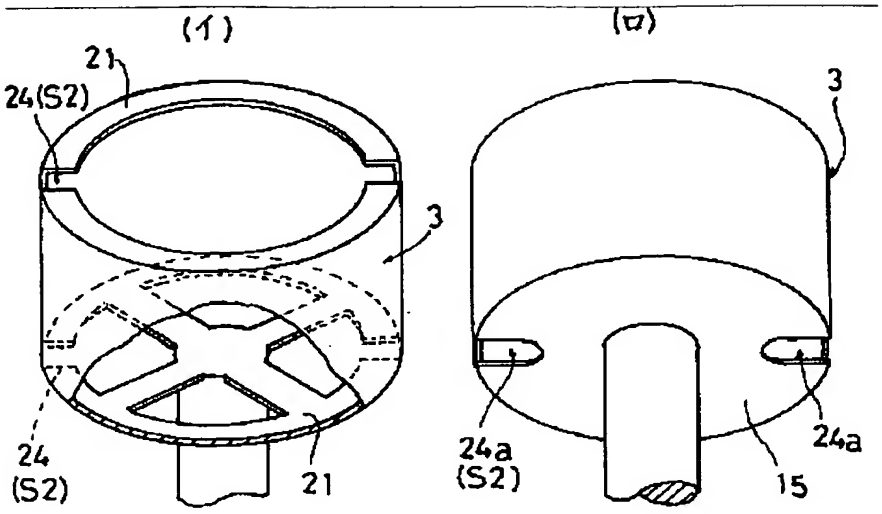
[Drawing 4]



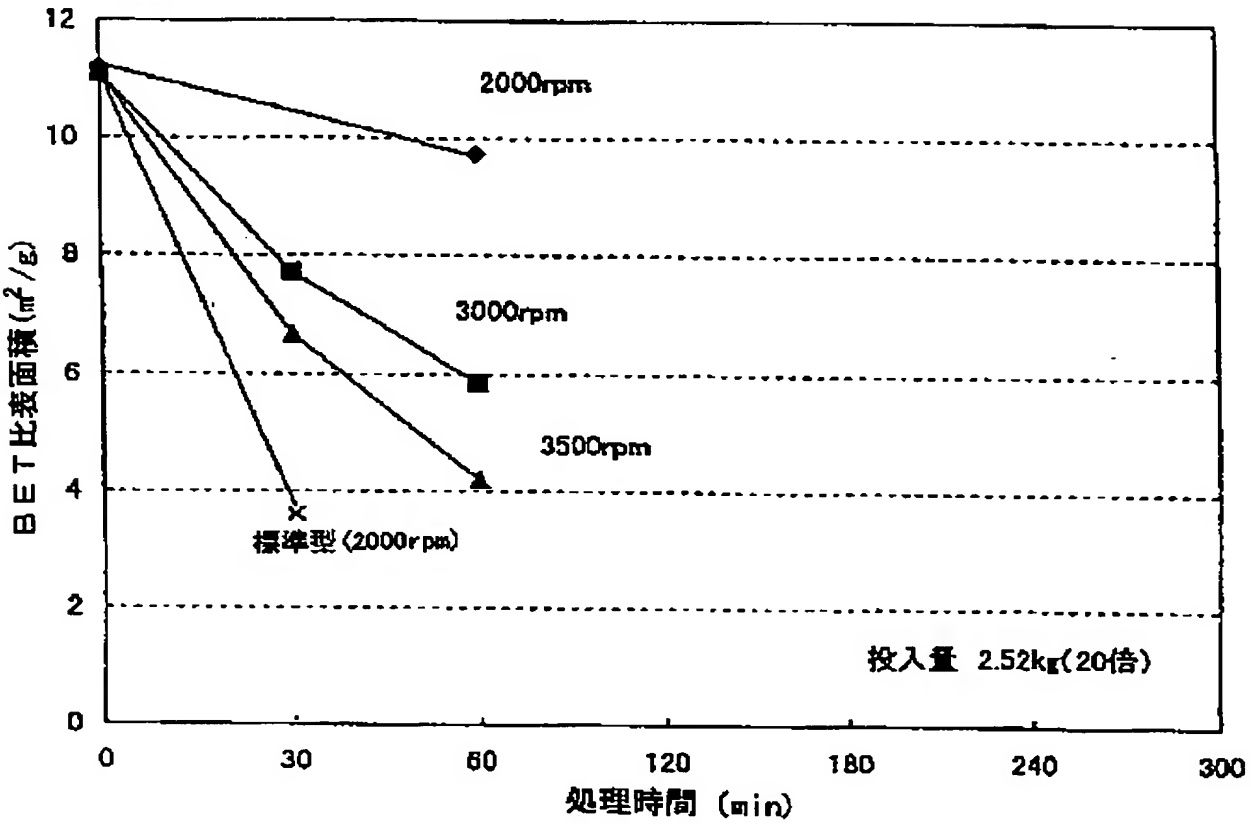
[Drawing 6]



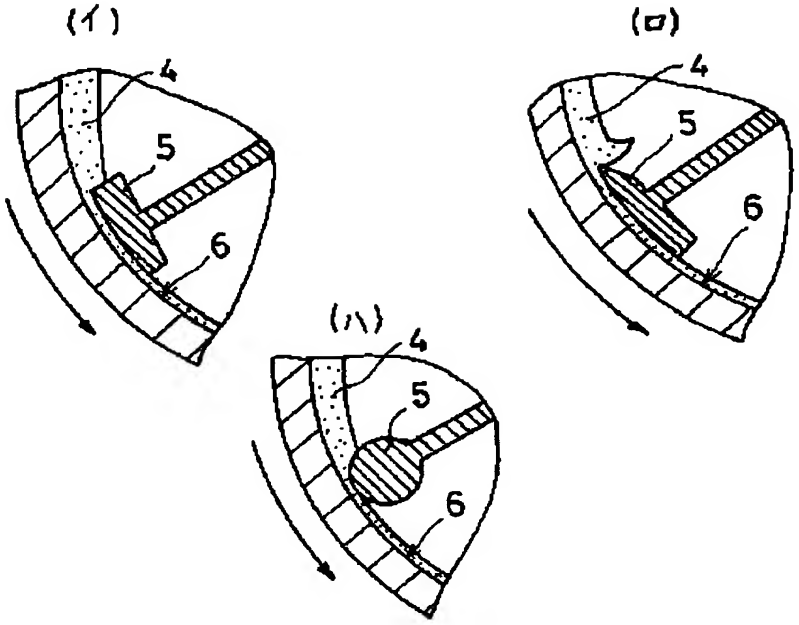
[Drawing 7]



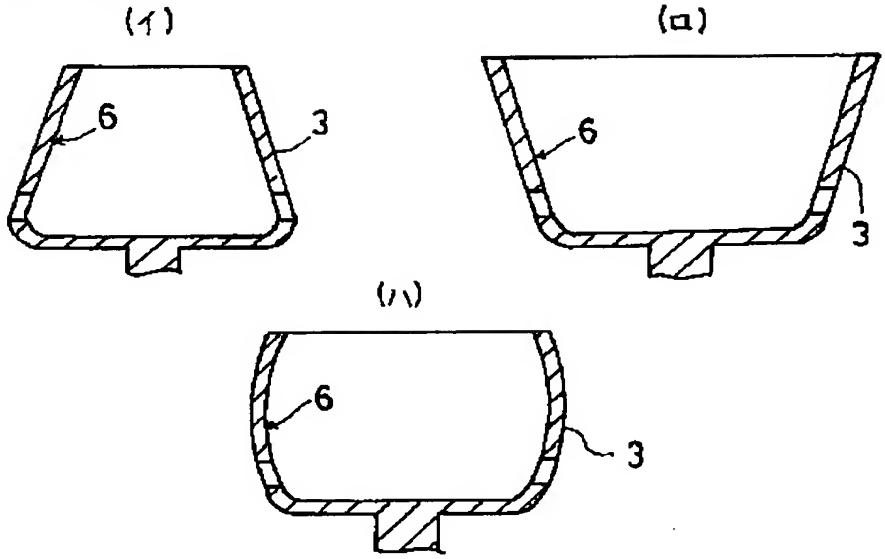
[Drawing 5]



[Drawing 8]



[Drawing 9]



[Drawing 10]